

PERA GmbH**EVALUATION OF THE SOLVENT POWER****Aim of the study**

The aim of the study is the measurement of the maximum solvent power of jojoba oil for different cosmetics ingredients. The test has been carried out in comparison to other three vegetal oils commonly used in cosmetics, at three different temperatures.

Oils in comparison with solvent characteristics

The oils used for the study included, besides the Jojoba oil, three vegetal oils commonly used in cosmetics, all supplied by PERA GmbH:

- Sunflower oil
- Almond oil
- Argan oil

Evaluated ingredients

The ingredients, whose solubility/miscibility has been evaluated, have been chosen among the organic ones, hardly soluble in traditional cosmetic vehicles, used in cosmetic formulae as active ingredients^a, stabilizers^b, structural ingredients^c or sunscreens^d:

- Salicylic acid ^a
- Resveratro l^a
- Azelaic acid ^a
- Glycyrrhetic acid ^a
- Menthol ^a
- Biotin ^a
- Boswellia serrata extract ^a
- Quercetin ^a
- Rosmarinus officinalis extract ^a
- Benzoic acid ^a
- BHA ^b
- BHT ^b
- Butyl Methoxydibenzoylmethane ^d
- Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine ^d
- Polysilicone-15 ^d
- Ceramide NP ^a
- Candelilla wax ^c
- Cera alba ^c

The evaluations have been performed at three different temperatures: room temperature (RT), 45°C and 60°C.

SALICYLIC ACID

- **JOJOBA OIL**
 - T 25°C = 0.23 %
 - T 45°C = 0.48 %
 - T 60°C = 1.00 %

- **SUNFLOWER OIL**
 - T 25°C = 0.12 %
 - T 45°C = 0.32 %
 - T 60°C = 0.65 %

- **ALMOND OIL**
 - T 25°C = 0.18 %
 - T 45°C = 0.33 %
 - T 60°C = 0.68 %

- **ARGAN OIL**
 - T 25°C = 0.23 %
 - T 45°C = 0.40 %
 - T 60°C = 1.65 %

Comments

Compared to salicylic acid, jojoba oil demonstrates, at RT, a solvent power comparable to argan oil, 91% and 27% higher respectively than sunflower and almond oils.

RESVERATROL

- **JOJOBA OIL**
 - T 25°C = 0.22 %
 - T 45°C = 0.22 %
 - T 60°C = 0.22 %

The system is homogeneous but cloudy

- **SUNFLOWER OIL**
 - T 25°C < 0.05 %
 - T 45°C < 0.05 %
 - T 60°C < 0.05 %

The system is homogeneous but cloudy

- **ALMOND OIL**
 - T 25°C < 0.05 %
 - T 45°C < 0.05 %
 - T 60°C < 0.05 %

The system is homogeneous but cloudy

- **ARGAN OIL**

- T 25°C < 0.05 %
- T 45°C < 0.05 %
- T 60°C < 0.05 %

The system is homogeneous but cloudy

Comments

Resveratrol is hardly soluble. Indeed, Jojoba oil shows higher wetting and suspending properties compared to the other 3 oils.

AZELAIC ACID

- **JOJOBA OIL**

- T 25°C < 0.10 %
- T 45°C < 0.10 %
- T 60°C < 0.10 %

The powder is suspended. Not soluble.

- **SUNFLOWER OIL**

- T 25°C < 0.10 %
- T 45°C < 0.10 %
- T 60°C < 0.10 %

The powder is suspended. Not soluble.

- **ALMOND OIL**

- T 25°C < 0.10 %
- T 45°C < 0.10 %
- T 60°C < 0.10 %

The powder is suspended. Not soluble.

- **ARGAN OIL**

- T 25°C < 0.10 %
- T 45°C < 0.10 %
- T 60°C < 0.10 %

The powder is suspended. Not soluble.

Comments

None of the oils shows a significant solvent or suspending power for azelaic acid.

GLYCYRRHETINIC ACID

- **JOJOBA OIL**

- T 25°C < 0.10 %
- T 45°C < 0.10 %
- T 60°C < 0.10 %

The system is homogeneous but cloudy

- **SUNFLOWER OIL**

- T 25°C < 0.15 %

- T 45°C < 0.15 %

- T 60°C < 0.15 %

The system is homogeneous but cloudy

- **ALMOND OIL**

- T 25°C < 0.10 %

- T 45°C < 0.10 %

- T 60°C < 0.10 %

The system is homogeneous but cloudy

- **ARGAN OIL**

- T 25°C < 0,15 %

- T 45°C < 0,15 %

- T 60°C < 0,15 %

The system is homogeneous but cloudy

Comments

The differences of suspending power among the four oils are negligible.

MENTHOL

- **JOJOBA OIL**

- T 25°C = 0.58 %

- T 45°C = 6.45 %

- T 60°C > 10 %

- **SUNFLOWER OIL**

- T 25°C = 0.58 %

- T 45°C = 6.45 %

- T 60°C > 10 %

- **ALMOND OIL**

- T 25°C = 0.68 %

- T 45°C = 9.70 %

- T 60°C > 10 %

- **ARGAN OIL**

- T 25°C = 0,71 %

- T 45°C > 10 %

- T 60°C > 10 %

Comments

There are no significant differences among oils when heated. At RT, almond oil dissolves 15% more menthol than jojoba oil, while argan oil by 18%. Sunflower oil is comparable to jojoba.

BIOTIN

- **JOJOBA OIL**
 - T 25°C < 0.20 %
 - T 45°C < 0.20 %
 - T 60°C < 0.20 %

- **SUNFLOWER OIL**
 - T 25°C < 0.20 %
 - T 45°C < 0.20 %
 - T 60°C < 0.20 %

- **ALMOND OIL**
 - T 25°C < 0.20 %
 - T 45°C < 0.20 %
 - T 60°C < 0.20 %

- **ARGAN OIL**
 - T 25°C < 0.20 %
 - T 45°C < 0.20 %
 - T 60°C < 0.20 %

Comments

There are no differences among the oils; this active ingredient is not soluble in the tested oils.

BOSWELLIA SERRATA EXTRACT

- **JOJOBA OIL**
 - T 25°C < 0.10 %
 - T 45°C < 0.10 %
 - T 60°C < 0.10 %

- **SUNFLOWER OIL**
 - T 25°C < 0.10 %
 - T 45°C < 0.10 %
 - T 60°C < 0.10 %

- **ALMOND OIL**
 - T 25°C < 0.10 %
 - T 45°C < 0.10 %
 - T 60°C < 0.10 %

- **ARGAN OIL**
 - T 25°C < 0.10 %
 - T 45°C < 0.10 %
 - T 60°C < 0.10 %

Comments

There are no differences among the oils; the active ingredient is not significantly soluble.

QUERCETIN

- **JOJOBA OIL**
 - T 25°C < 0.05 %
 - T 45°C < 0.05 %
 - T 60°C < 0.05 %Cloudy system

- **SUNFLOWER OIL**
 - T 25°C < 0.05 %
 - T 45°C < 0.05 %
 - T 60°C < 0.05 %Cloudy system

- **ALMOND OIL**
 - T 25°C < 0.05 %
 - T 45°C < 0.05 %
 - T 60°C < 0.05 %Cloudy system

- **ARGAN OIL**
 - T 25°C < 0.05 %
 - T 45°C < 0.05 %
 - T 60°C < 0.05 %Cloudy system

Comments

There are no differences among the oils; the active ingredient is not significantly soluble.

ROSMARINUS OFFICINALIS EXTRACT

- **JOJOBA OIL**
 - T 25°C < 0.10 %
 - T 45°C < 0.10 %
 - T 60°C < 0.10 %

- **SUNFLOWER OIL**
 - T 25°C < 0.10 %
 - T 45°C < 0.10 %
 - T 60°C < 0.10 %

- **ALMOND OIL**
 - T 25°C < 0.10 %
 - T 45°C < 0.10 %
 - T 60°C < 0.10 %

- **ARGAN OIL**
 - T 25°C < 0.10 %
 - T 45°C < 0.10 %
 - T 60°C < 0.10 %

Comments

There are no differences among the oils; the active ingredient is not significantly soluble.

BENZOIC ACID

- **JOJOBA OIL**
 - T 25°C = 0.70 %
 - T 45°C = 1.50 %
 - T 60°C = 4.20 %
- **SUNFLOWER OIL**
 - T 25°C = 0.60 %
 - T 45°C = 0.82 %
 - T 60°C = 4.50 %
- **ALMOND OIL**
 - T 25°C = 0.70 %
 - T 45°C = 2 %
 - T 60°C = 4.50 %
- **ARGAN OIL**
 - T 25°C = 0.80 %
 - T 45°C = 3 %
 - T 60°C = 4.50 %

Comments

There are no differences among the oils, the preservative ingredient dissolves always in a comparable way, both at RT and at higher temperatures.

BHA

- **JOJOBA OILS**
 - T 25°C > 30 %

- **SUNFLOWER OIL**
 - T 25°C > 30 %

- **ALMOND OIL**
 - T 25°C > 30 %

- **ARGAN OIL**
 - T 25°C > 30 %

Comments

Considering the high solubility at RT, no tests were carried out at 45°C and 60°C. The antioxidant can be dissolved indifferently in one of the four oils.

BHT

- **JOJOBA OIL**
 - T 25°C > 30 %

- **SUNFLOWER OIL**
 - T 25°C > 30 %

- **ALMOND OIL**
 - T 25°C > 30 %

- **ARGAN OIL**
 - T 25°C > 30 %

Comments

Considering the high solubility at RT, no tests were carried out at 45°C and 60°C. The antioxidant can be dissolved indifferently in one of the four oils.

BUTYL METHOXYDIBENZOYLMETHANE

- **JOJOBA OIL**
 - T 25°C = 6.60 %
 - T 45°C = 10.60 %
 - T 60°C > 25 %

- **SUNFLOWER OIL**
 - T 25°C = 8.60 %
 - T 45°C = 12.20 %
 - T 60°C > 25 %

- **ALMOND OIL**
 - T 25°C = 8.40 %
 - T 45°C = 10.60 %
 - T 60°C > 25 %

- **ARGAN OIL**
 - T 25°C = 6.90 %
 - T 45°C = 13.80 %
 - T 60°C > 25 %

Comments

By cooling, immediate crystallization is observed in all the oils. Hot oils have comparable solvent power, cold jojoba and argan oils are lower as solvent power than the two other by about 23%.

BIS-ETHYLHEXYLOXYPHENOL METHOXYPHENYL TRIAZINE

- **JOJOBA OIL**
 - T 25°C = 5 %
 - T 45°C = 6.90 %
 - T 60°C = 16.30 %

- **SUNFLOWER OIL**
 - T 25°C = 5 %
 - T 45°C = 7 %
 - T 60°C = 20 %

- **ALMOND OIL**
 - T 25°C = 5 %
 - T 45°C = 6.70 %
 - T 60°C = 11.90 %

- **ARGAN OIL**
 - T 25°C = 5 %
 - T 45°C = 6.80 %
 - T 60°C = 11.90 %

Comments

By cooling, precipitation does not occur instantaneously, but after 48h. Hot jojoba oil is excellent to solubilize this filter, almost comparable to sunflower but clearly superior to the other two. Therefore it can be use successfully in sunscreen formulae.

POLYSILICONE-15

Added at 10% in each oil causes turbidity, even when heated to 45°C and 60°C. Not miscible with the oils.

CERAMIDE NP

- **JOJOBA OIL**
 - T 25°C < 0.01 %
 - T 45°C < 0.01 %
 - T 60°C < 0.01 %
- **SUNFLOWER OIL**
 - T 25°C < 0.01 %
 - T 45°C < 0.01 %
 - T 60°C < 0.02 %
- **ALMOND OIL**
 - T 25°C < 0.01 %
 - T 45°C < 0.01 %
 - T 60°C < 0.01 %
- **ARGAN OIL**
 - T 25°C < 0.01 %
 - T 45°C < 0.01 %
 - T 60°C < 0.01 %

Comments

There are no differences among the oils; this active ingredient is not soluble.

CERA CANDELILLA

In none of the tested oils, it was possible to melt this wax at the above used temperatures. By heating the oil to 70°C, we succeeded in its incorporation. 10% wax was added to each oil.

By cooling to room temperature, pastes of different texture were obtained, depending on the oil.

- **ALMOND OIL**
 - Soft texture paste

- **JOJOBA OIL, SUNFLOWER OIL, ARGAN OIL**
 - Hard texture gel, comparable for the three oils.

Comments

These behaviors are to be considered in the formulation of lipsticks and mascaras.

CERA ALBA

In none of the tested oils, it was possible to melt the wax at the above used temperatures. By heating the oils to 70°C, the incorporation was possible. 10% wax was added to each oil.

By cooling to room temperature, pastes of different consistency were obtained, depending on the oil.

- **JOJOBA OIL**
 - Very soft texture

- **ARGAN OIL**
 - Soft texture

- **SUNFLOWER OIL**
 - Hard texture

- **ALMOND OIL**
 - Very hard texture

Comments

The behavior of the different oils with this wax opens up interesting possibilities of application in the formulation of lipsticks and mascaras.

FINAL CONCLUSIONS

As far as its solvent power towards sparingly soluble ingredients commonly used in cosmetics, Jojoba oil is generally comparable and in some cases superior to the selected vegetal triglycerides.

Jojoba oils has the advantage of higher oxidation stability and better sensorial performances than the other tested oils.

Moreover, its behavior with waxes commonly used in the formulation of mascara and lipsticks offer to formulators the possibility of finely tuning the application characteristics of the formulae.

Jojoba oil can be used to dissolve easily benzoic acid, salicylic acid and menthol.

Finally, jojoba oil shows far better wetting and suspending properties for resveratrol when compared to the other tested oils.